

QUALITY ASSURANCE PROJECT PLAN
OMEGA CHEMICAL SUPERFUND SITE OPERABLE UNIT 2
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

MONTEBELLO FOREBAY
LOS ANGELES, CALIFORNIA

EPA CONTRACT NO. 68-W-98-225
EPA WORK ASSIGNMENT NO. 175-RICO-09BC
CH2M HILL PROJECT NO. 183122

Prepared for
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Prepared by
CH2M HILL
164 West Hospitality Lane, Suite 2
San Bernardino, California 92408

April 2004

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U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IX

Plan Title: Quality Assurance Project Plan Omega Chemical Superfund Site
Operable Unit 2 Remedial Investigation/Feasibility Study

Site Name: Omega Chemical Superfund Site

Site Location: Whittier

City/State/Zip: Los Angeles County, California

Site EPA ID#: 09BC

Anticipated Sampling Dates: 2004 to 2005

Prepared By: Tom Perina

Date: April 2004

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Acronyms

AL	action level
AN	analytical support and data validation
AOC	administrative order on consent
ARAR	Applicable or Relevant and Appropriate Requirements
BOD	biological oxygen demand
CCR	California Code of Regulations
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
CLP	Contract Laboratory Program
COC	chain-of-custody
COD	chemical oxygen demand
Cr (VI)	hexavalent chromium
CRDL	contract-required detection levels
1,1-DCE	1,1-dichloroethene
DE	data evaluation
DHS	Department of Health Services
DQO	data quality objective
EC	electrical conductivity
EE/CA	engineering evaluation/corrective action
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
FAR	Federal Acquisition Regulations
Freon 11	trichlorofluoromethane
Freon 113	trichlorotrifluoroethane
FSP	field sampling plan
GAC	granular activated carbon
GC	gas chromatography
GIS	geographic information system

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HHRA	human health risk assessment
HSP	health and safety plan
IDW	investigation-derived waste
LOE	level of effort
MAU	middle alluvial unit
MCL	maximum contaminant level
MDL	method detection limit
µg/L	micrograms per liter
MNA	monitored natural attenuation
MP	multiport
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
MTBE	methyl tert-butyl ether
NDMA	n-nitrosodimethylamine
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OEHHA	Office of Environmental Health Hazard Assessment
OPOG	Omega Chemical Site Potentially Responsible Party Organized Group
OU	operable unit
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PCE	perchloroethene (tetrachloroethene)
PHG	public health goal
ppb	parts per billion
ppm	parts per million
PRP	potentially responsible party
QA/QC	quality assurance/quality control
QAO	quality assurance officer
QAPP	quality assurance project plan
RA	remedial action
RAC	response action contract
RCRA	Resource Conservation and Recovery Act

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RD	remedial design
RFA	request for analyses
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RPD	relative percent difference
RPM	remedial project manager
RSCC	Regional Sample Control Center
RSD	relative standard deviation
RTL	review team leader
SM	site manager
SOW	statement of work
SRM	standard reference material
SSC	site safety coordinator
STL	sampling team leader
SVOC	semivolatile organic compound
1,2,3-TCP	1,2,3-trichloropropane
TAL	Target Analyte List
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCL	target compound list
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSDF	treatment, storage, and disposal facility
UAU	upper alluvial unit
VOC	volatile organic compound
WA	work assignment
WAM	work assignment manager

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Introduction

This Quality Assurance Project Plan (QAPP) follows United States Environmental Protection Agency (EPA) guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (EPA, 2002), and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001). Thus, the following section headings correlate with the subtitles found in the EPA guidelines.

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Section A

Project Management/Data Quality Objectives

A.1 Project Organization

This work assignment issued under EPA Response Action Contract (RAC) Assignment No. 174-RSBD-09BC has a site manager (SM) who works directly with the EPA work assignment manager (WAM) to accomplish the work assignment. The SM will manage the financial, schedule, and technical status of the work assignment. The key people involved in interfacing with the SM are the WAM, quality assurance officer (QAO), senior reviewer/review team leader (RTL), and individual task managers for field sampling (sampling team leader, or STL).

The primary responsibility for project quality rests with the SM. Independent quality control (QC) is provided by the RTL and QAO. The RTL/review team and QAO will review project planning documents, data evaluation, and deliverables.

The sampling team will implement the QAPP/field sampling plan (FSP)/health and safety plan (HSP). The site safety coordinator (SSC) is responsible for adherence to the HSP and field decontamination procedures. The entire field effort is directed by the STL.

The subcontract administrator is responsible for procuring subcontracts for EPA's RAC projects under Federal Acquisition Regulations (FAR), and provides the interface with subcontractors. Subcontractors may be utilized on this work assignment for laboratory analyses, depending on EPA regional laboratory availability.

Where quality assurance (QA) problems or deficiencies requiring special action are uncovered, the SM, RTL, and QAO will identify the appropriate corrective action to be initiated by the STL or the laboratory.

Project organization and the line of authority for CH2M HILL efforts are illustrated in Figure A-1. Data users and recipients are shown in Figure A-2. Both EPA and CH2M HILL technical personnel and QA personnel are shown.

The organizational functions noted above are consistent with the overall RAC IX Program Plan; these functions are further detailed in the program plan.

A.2 Problem Definition/Background

A.2.1 Purpose

This QAPP presents the policies, organizations, objectives, and functional activities/procedures associated with the remedial investigation sampling/analysis and construction activities at Omega Chemical Superfund Site and accompanies the data quality objectives (DQOs), which can be found in Appendix A (EPA, 1994 and 2000).

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This QAPP follows EPA guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (EPA, 1998 and 2002), and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001). Thus, the following section headings correlate with the subtitles found in the EPA guidelines.

A.2.2 Problem Statement

Existing groundwater and soil data indicate that elevated concentrations of volatile organic compounds (VOCs) and other compounds are present in the soil and groundwater beneath the former Omega Chemical Facility (Operable Unit 1 [OU-1]) and up to 2 miles downgradient in shallow groundwater. A series of soil gas, soil, and groundwater investigations has been performed at OU-1 by a variety of consultants beginning in 1985. Chlorinated hydrocarbons (primarily perchloroethene [PCE], trichloroethene [TCE], 1,1-dichloroethene [1,1-DCE], cis-1,2-dichloroethene [cis-1,2-DCE], and chloroform) and Freons (trichlorofluoromethane [Freon 11] and trichlorotrifluoroethane [Freon 113]) were identified as the primary chemicals of concern directly beneath the site. Elevated total chromium also was reported in groundwater beneath the Omega site. Perchlorate contamination is suspected. Other contaminants of concern (detected or suspected at the site) include cyanides, n-nitrosodimethylamine (NDMA), pesticides and polychlorinated biphenyls (PCBs), dissolved metals, and 1,4-dioxane. Elevated concentrations of chemicals of concern were also reported west and southwest of the Omega facility, suggesting that a downgradient migration of the contaminant plume from the site has occurred.

OU-2 generally includes the groundwater-contaminated areas encompassing the Omega Chemical Facility and extends approximately 2.2 miles to the southwest. The vadose zone contamination at the Omega site and the highly contaminated portion of the aquifer in the immediate site vicinity are addressed as OU-1 under a separate effort. The primary objective of this investigation is to conduct a remedial investigation/feasibility study (RI/FS) to estimate the vertical and lateral extent of groundwater contamination within OU-2. An investigation of potential source areas other than the Omega facility is not included in this QAPP, and will be addressed by an addendum to this document after additional information (records search) becomes available. It is anticipated that this future investigation will include soil gas and soil sampling, well installation, and aquifer testing.

A.2.3 Background

The Omega Chemical Corporation (Omega) is a former refrigerant/solvent recycling operation located in Whittier, California, a community of approximately 85,000 people. The facility is located across the street from a residential neighborhood and within 1 mile of several schools, including three elementary schools and two high schools. The facility operated as a Resource Conservation and Recovery Act (RCRA) solvent and refrigerant recycling and treatment facility from approximately 1976 to 1991, handling primarily chlorinated hydrocarbons and chlorofluorocarbons. Drums and bulk loads of waste solvents and chemicals from various industrial activities were processed at Omega to form commercial products. Chemical, thermal, and physical treatment processes were reportedly used to recycle the waste materials. Wastes generated from these treatment and recycling activities included distillation column (still) bottoms, aqueous fractions, and non-recoverable solvents. Additional data regarding site history, past investigations, and remediation activities are discussed in detail in the *Final On-Site Soils RI/FS Work Plan*

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(Camp Dresser & McKee [CDM], 2003) and the *Omega Chemical Superfund Site; Whittier, California; Phase 2 Groundwater Characterization Study Report* (Weston Solutions, Inc. [Weston], 2002).

A.2.4 Data Needs and Uses

Data needs and uses for the objectives described in this section have been identified through the DQO process presented in Appendix A. The data needs and uses are summarized in Table A-1 at the end of this section. Table A-1 lists the analytes of concern and presents regulatory criteria/action level requirements for organics and inorganics. The table presents a listing of applicable regulations and identifies the lowest regulatory criteria where there are multiple regulatory criteria/action levels for a given analyte. Table A-2 lists the analytical methods and laboratory reporting limits selected to meet these criteria.

A.3 Project Description and Schedule

A.3.1 Description of Work to be Performed

A summary of the work to be performed relating to sample collection, analysis, and interpretation is provided below.

Field Investigation

CH2M HILL will conduct the RI/FS field investigation at OU-2. Samples will include surface and subsurface soil samples, soil gas samples, groundwater samples, and associated field duplicates.

Sample Analysis

Sample analyses will be carried out by the EPA Contract Laboratory Program (CLP), Regional Laboratory, and Contract Laboratories as needed.

Analytical Support and Data Validation

All data for all parameters will undergo two levels of review and validation: (1) at the laboratory, and (2) outside the laboratory by the EPA QA management section or their designee.

Data Evaluation

CH2M HILL will organize and evaluate existing data and data gathered from this investigation. The data evaluation activities will include:

- Data usability evaluation and field QA/QC
- Data reduction, tabulation, and evaluation
- Preparing a data evaluation report

A brief data evaluation report will be prepared after each sampling event. The data reports will include sampling location maps and results tables for each medium sampled (soil, soil gas, and groundwater) and provide prior sampling results where appropriate for comparison and evaluation. The results and findings from data validation and data usability review will be summarized and incorporated into each data report. The validated

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concentration data will be used in numerical modeling of the fate and transport of the contaminants dissolved in groundwater at the site.

Assessment of Risk

CH2M HILL will provide an evaluation and assessment of risk to human health and the environment posed by site contaminants. The risk assessment will account for both OU-1 and OU-2 and will include the following:

- Determination of the current or potential risk to human health and the environment posed by site contaminants in the absence of any remedial action
- Contaminant identification, exposure assessment, toxicity assessment, and risk characterization
- Determination of the necessity of a remedial action at the site, justification for performing remedial action, and determination of exposure pathways that need to be removed

CH2M HILL will prepare a Human Health Risk Assessment report that includes the following:

- Hazard identification (sources)
- Dose-response assessment
- Conceptual exposure/pathway analysis
- Characterization of site and potential receptors
- Exposure assessment
- Risk characterization
- Identification of limitations/uncertainties
- Site conceptual model

CH2M HILL will prepare an Ecological Risk Assessment report that includes the following:

- Hazard identification (sources)
- Dose-response assessment
- Conceptual exposure/pathway analysis
- Critical exposure pathways (e.g., surface water)
- Characterization of site and potential receptors
- Select chemicals, indicator species, and end points
- Exposure assessment
- Toxicity assessment/ecological effects assessment
- Risk characterization
- Identification of limitations/uncertainties
- Site conceptual model

Remedial Investigation Report

CH2M HILL will prepare a Remedial Investigation Report that establishes the site characteristics such as media contaminated, extent of contamination, and the physical boundaries of the contamination, and will assess the fate and transport of the contamination.

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A.3.2 Schedule of Activities

The field investigation is expected to start in mid-2004 and will last approximately 2 years.

A.4 Data Quality Objectives

A.4.1 Project Quality Objectives

The specific needs for data that will be collected during each activity were examined to evaluate whether project objectives for the remedial investigation are optimally achieved. Specific DQOs were considered independently through the DQO process (EPA, 1994 and 2000) to meet the data user's needs for each activity. Appendix A presents the DQO decision-making process for the remedial field activities.

A.4.2 Measurement Performance Criteria

The QA objective of this plan is to develop implementation procedures that will provide data of known and appropriate quality for the needs identified in previous sections. Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. These terms, the applicable procedures, and level of effort are described below.

The applicable QC procedures, quantitative target limits, and level of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical methods. Analytical parameters and applicable detection levels, analytical precision, accuracy, and completeness in alignment with needs identified in Section A-2.4 are presented in Table A-2.

Reporting detection levels/target detection limits listed in Table A-2 are per-method reporting limits, equivalent to contract-required detection levels (CRDLs). "Target" implies that final sample detection levels may be higher because of sample matrix effects. Detection levels for the individual samples will be reported in the final data. Laboratory-specific method detection limits (MDLs) are significantly below reporting levels. Where reporting limits are higher than regulatory limits, the project team will use MDLs as needed for project decisions. This is not expected to impact project decisions.

Representativeness is a measure of how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. Sampling plan design, sampling techniques, and sample-handling protocols (e.g., for storage, preservation, and transportation) have been developed, and are discussed in subsequent sections of this document. The proposed documentation will establish that protocols have been followed and sample identification and integrity ensured.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using defined procedures and the use of consistent methods and consistent units. Actual detection limits will depend on the sample matrix and will be reported as defined for the specific samples.

Accuracy is an assessment of the closeness of the measured value to the true value. For samples, accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. For a matrix spike, known amounts of a

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standard compound identical to the compounds being measured are added to the sample. A quantitative definition of average recovery accuracy is given in Section D.3. The level of effort (LOE) for accuracy measurements will be a minimum frequency of 1 in 20 samples analyzed.

Precision is a measure of the data spread when more than one measurement has been collected from the same sample. Precision can be expressed as the relative percent difference; a quantitative definition is given in Section D.3. The LOE for precision measurements will be a minimum of 1 in 20 samples analyzed.

Completeness is a measure of the amount of valid data obtained from the analytical measurement system and the complete implementation of defined field procedures. The quantitative definition of completeness is given in Section D.3. The target completeness objective will be 90 percent; the actual completeness may vary depending on the intrinsic nature of the samples. The completeness of the data will be assessed during QC reviews.

A.5 Special Training Requirements/Certification (A8)

All project staff working on the site will be health and safety trained, and will follow requirements specified in the Health and Safety Plan (HSP) for the project, which can be found in the companion FSP (EPA, 2004). The HSP describes the specialized training required for personnel on this project and the documentation and tracking of this training.

A.6 Documentation and Records

Field documentation and records will be as described in Section B and the FSP. Laboratory documentation will be per: (1) methods and QA protocols listed in Section B, and (2) EPA Regional Laboratory specific standard operating procedures. Overall project documentation will be per the EPA Region IX RAC Program Plan.

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TABLE A-1
 Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega DU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
TCL Volatile Organic Compounds				
Acetone	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design. Evaluate remedial action performance.	1	CA Primary MCL ^(A)	0.5
Benzene		100	USEPA Primary MCL ^(C)	0.5
Bromodichloromethane		100	USEPA Primary MCL ^(C)	0.5
Bromoform		500	CA Proposition 65 Regulatory Level ^(I)	0.5
Bromomethane		260	CA DHS State Action Level ^(F)	
n-Butylbenzene		260	CA DHS State Action Level ^(F)	
sec-Butylbenzene		160	CA DHS State Action Level ^(F)	
Carbon disulfide		0.5	CA Primary MCL ^(A)	0.5
Carbon tetrachloride		100	USEPA Primary MCL ^(C)	
Chlorobenzene		16	Other Taste and Odor ^(H)	0.5
Chloroethane			No Applicable ARAR	
Chloroform		140	CA DHS State Action Level ^(F)	
Chloromethane		140	CA DHS State Action Level ^(F)	
2-Chlorotoluene				
4-Chlorotoluene		0.2	USEPA Primary MCL ^(C)	
Cyclohexane		0.05		
Dibromomethane		600	CA DHS State Action Level ^(G)	0.5
Dibromochloromethane		600	CA DHS State Action Level ^(G)	0.5
Dibromochloropropane (DBCP)		5	CA Primary MCL ^(A)	0.5
1,2-Dibromoethane		1,000	CA DHS State Action Level ^(F)	
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
Dichlorodifluoromethane				

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Quality Assurance Project Plan, Omega OU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
1,1-Dichloroethane	Exceedances with respect to federal and state drinking water standards, and state action levels.	5	CA Primary MCL ^(A)	0.5
1,2-Dichloroethane		0.5	CA Primary MCL ^(A)	0.5
1,1-Dichloroethylene	Evaluate water treatment system design.	6	CA Primary MCL ^(A)	0.5
cis-1,2-Dichloroethylene		6	CA Primary MCL ^(A)	0.5
trans-1,2-Dichloroethylene	Evaluate remedial action performance.	10	CA Primary MCL ^(A)	0.5
Dichloromethane (Methylene Chloride)		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5
1,2-Dichloropropane	↓	5	CA/USEPA Primary MCL ^{(A) (C)}	0.5
2,2-Dichloropropane				
1,1-Dichloropropane				
1,3-Dichloropropane		0.5	CA Primary MCL ^(A)	
cis-1,3-Dichloropropene		0.5	CA Primary MCL ^(A)	0.5
trans-1,3-Dichloropropene		0.5	CA Primary MCL ^(A)	0.5
Ethane				
Ethene				
Ethylbenzene		300	CA Primary MCL ^(A)	0.5
Hexachlorobutadiene				
2-Hexanone				
Isopropylbenzene (Cumene)		770	CA DHS State Action Level ^(F)	0.5
Methane				
Methyl acetate				
Methyl ethyl ketone		8,400	Other Taste and Odor ^(F)	5
Methyl isobutyl ketone (MIBK)		120	CA DHS State Action Level ^(F)	
Methylcyclohexane				
Napthalene		170	CA DHS State Action Level ^(F)	
n-Propylbenzene		260	CA DHS State Action Level ^(F)	

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Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Quality Assurance Project Plan, Omega OU-2				
Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
Styrene	<div>Exceedances with respect to federal and state drinking water standards, and state action levels.</div> <div>Evaluate water treatment system design.</div> <div>Evaluate remedial action performance.</div> <div>↓</div>	100	CA/USEPA Primary MCL ^{(A) (C)}	0.5
1,1,2,2-Tetrachloroethane		1	CA Primary MCL ^(A)	0.1
Tetrachloroethylene (PCE)		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5
Toluene		150	CA Primary MCL ^(A) /CA PHG ^(B)	0.5
1,2,3-Trichlorobenzene				
1,2,4-Trichlorobenzene		5	CA Primary MCL ^(A) /CA PHG ^(B)	0.5
1,1,1-Trichloroethane (1,1,1-TCA)		200	CA/USEPA Primary MCL ^{(A) (C)}	0.5
1,1,2-Trichloroethane		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5
Trichloroethylene (TCE)		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5
Trichlorofluoromethane		150	CA Primary MCL ^(A)	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		1,200	CA Primary MCL ^(A)	10
1,2,4-Trimethylbenzene		330	CA DHS State Action Level ^(F)	
1,3,5-Trimethylbenzene		330	CA DHS State Action Level ^(F)	
Vinyl chloride		0.5	CA Primary MCL ^(A)	0.5
Xylene(s)		1,750	CA Primary MCL ^(A)	1,800
Additional Volatiles				
Methyl tert-butyl ether (MTBE)	Exceedances with respect to federal and state drinking water standards, and state action levels	13	CA Secondary MCL ^(B)	3

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Quality Assurance Project Plan, Omega OU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
TCL Semivolatile Organic Compounds				
Acenaphthene	Exceedances with respect to federal and state drinking water standards, and state action levels.	0.2	CA/USEPA Primary MCL ^{(A) (C)}	0.1
Acenaphthylene				
Acetophenone				
Aniline (Phenylamine) (Aminobenzene)	Evaluate water treatment system design.			
Anthracene	Evaluate remedial action performance.			
Benzaldehyde	↓			
Benzoic Acid (Carboxybenzene)				
Benzo(a)anthracene				
Benzo(a)pyrene				
Benzo(b)fluoranthene				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene				
Benzyl Alcohol (Phenylmethanol)				
1,1'-Biphenyl				
Bis(2-chloroethoxy)methane				
Bis(2-chloroethyl)ether				
Bis(2-chloroisopropyl)ether				
4-Bromophenyl-phenyl ether				
Butylbenzyl phthalate (BBP)				
Caprolactam				
Carbazole				
4-Chloro-3-methylphenol				
4-Chloroaniline				

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TABLE A-1
Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
2-Chloronaphthalene	Exceedances with respect to federal and state drinking water standards, and state action levels.			
2-Chlorophenol				
4-Chlorophenyl-phenyl ether	Evaluate water treatment system design.	400	CA/USEPA Primary MCL ^{(A) (C)}	5
Chrysene		4	CA Primary MCL ^(A)	3
Di(2-ethylhexyl)adipate	Evaluate remedial action performance.			
Di(2-ethylhexyl)phthalate				
Dibenz(a,h)anthracene	↓			
Dibenzofuran (Diphenylene oxide)				
3,3'-Dichlorobenzidine				
2,4-Dichlorophenol				
Diethyl phthalate (DEP)				
Dimethyl phthalate				
2,4-Dimethylphenol		100	CA DHS State Action Level ^(F)	
4,6-Dinitro-2-methylphenol				
2,4-Dinitrophenol				
2,4-Dinitrotoluene				
2,6-Dinitrotoluene				
Di-n-butylphthalate (Dibutyl phthalate)				
Di-n-octylphthalate(Dioctyl phthalate)				
Endothall		100	CA/USEPA Primary MCL ^{(A) (C)}	45
Fluoranthene (Idryl)				
Fluorene				
Glyphosate		700	CA/USEPA Primary MCL ^{(A) (C)}	25
Hexachlorobenzene		1	CA/USEPA Primary MCL ^{(A) (C)}	0.5

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TABLE A-1

Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds

Quality Assurance Project Plan, Omega OU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
Hexachlorocyclopentadiene	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design. Evaluate remedial action performance. ↓	50	CA/USEPA Primary MCL ^{(A) (C)}	1
Hexachloroethane				
Indeno(1,2,3-cd)pyrene				
Isophorone				
2-Methylnaphthalene				
2-Methylphenol				
4-Methylphenol				
3,4-Methylphenol				
2-Nitroaniline				
3-Nitroaniline				
2-Nitrophenol				
4-Nitroaniline				
4-Nitrophenol				
Pentachlorophenol		1	CA/USEPA Primary MCL ^{(A) (C)}	0.2
Phenanthrene				
Phenol		4,200	CA DHS State Action Level ^(F)	
Pyrene				
Pyridine				
2,4,6-Trichlorophenol				
2,4,5-Trichlorophenol				
Emergent Compounds	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design.			
1,4-Dioxane		3	CA DHS State Action Level ^(F)	
N-Nitrosodimethylamine (NDMA)		0.01	CA DHS State Action Level ^(F)	
1,2,3-Trichloropropane (1,2,3-TCP)		0.005	CA DHS State Action Level ^(F)	

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TABLE A-1
Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Organic Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾
Treatment/Discharge Parameters				
Total Organic Parameters	Evaluate groundwater treatment alternatives.			
Total Organic Carbon				
Biological Oxygen Demand	Evaluate treated groundwater discharge alternatives.			
Chemical Oxygen Demand				

Notes:

(1) ARARs from June 2003 California EPA Compilation of Water Quality Goals and Updates through September 2003.

(2) California Department of Health Services required Detection limit for Purposes of Reporting (DLR).

(3) Calculated ARAR based on hardness = 120 mg/L as CaCO₃

(A) CA Department of Health Services Primary MCL for Drinking Water.

(B) CA Department of Health Services Secondary MCL for Drinking Water.

(C) USEPA Primary MCL for Drinking Water.

(D) USEPA Secondary MCL for Drinking Water.

(E) CA Office of Environmental Health Hazard Assessment Public Health Goal for Drinking Water.

(F) CA Department of Health Services State Action Level for Toxicity.

(G) CA Department of Health Services State Action Level for Taste and Odor.

(H) Other Taste and Odor Thresholds.

(I) CA Proposition 65 Regulatory Level for Drinking Water.

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TABLE A-1
Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Inorganic Parameter	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DH DLR (µg/L) ⁽³⁾
Emergent Compounds				
Chromium (VI)	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design.	11 (0.2) ⁴	California Toxics Rule for Aquatic Life Protection ⁽¹⁴⁾	1
Perchlorate		4	CA DHS State Action Level ⁽¹⁵⁾	4 (preliminary)
TAL Inorganics				
Aluminum	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate groundwater treatment alternatives and treated groundwater discharge options.	50	USEPA Secondary MCL ⁽¹¹⁾	50
Antimony		6	CA/USEPA Primary MCL ^{(A) (C)}	6
Arsenic		10	USEPA Primary MCL ^(C)	2
Barium		1,000	CA Primary MCL ^(A)	100
Beryllium		4	CA/USEPA Primary MCL ^{(A) (C)}	1
Cadmium		5	CA/USEPA Primary MCL ^{(A) (C)}	1
Calcium				
Chromium (total)		50	CA Primary MCL ^(A)	10
Cobalt				
Copper		11 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ⁽¹⁴⁾	50
Iron		300	CA/USEPA Secondary MCL ^{(B) (D)}	100
Lead		3.1	California Toxics Rule for Aquatic Life Protection ⁽¹⁴⁾	5
Magnesium				
Manganese		50	CA/USEPA Secondary MCL ^{(B) (D)}	20
Mercury		2	CA/USEPA Primary MCL ^{(A) (C)}	1
Molybdenum				
Nickel		61	California Toxics Rule for Aquatic Life Protection ⁽¹⁴⁾	10
Potassium				
Selenium		5	California Toxics Rule for Aquatic Life Protection ⁽¹⁴⁾	5

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TABLE A-1
Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Inorganic Parameter	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DH DLR (µg/L) ⁽³⁾
Silver	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate groundwater treatment alternatives and treated groundwater discharge options.	4.7 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ⁽¹⁾	10
Sodium				
Thallium		2.0	CA/USEPA Primary MCL ^{(A) (C)}	1
Vanadium		50	CA DHS State Action Level ^(F)	3 (preliminary)
Zinc		140 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ⁽⁴⁾	50
Cyanide		5.2	California Toxics Rule for Aquatic Life Protection ⁽⁴⁾	100
Additional Inorganics				
Boron	Evaluate groundwater treatment alternatives and treated groundwater discharge options	1,000	CA DHS State Action Level ^(F)	
Silicon				
Treatment/Discharge Parameters				
pH	Evaluate groundwater treatment alternatives and treated groundwater discharge options	6.5 to 8.5	USEPA Secondary MCL ^(D)	
Alkalinity				
Ammonia		500	Other Tastes and Odors ⁽⁴⁾	
Bicarbonate	Exceedances with respect to federal and state drinking water standards, and state action levels			
Bromide				
Chloride		250,000	CA/USEPA Secondary MCL ^(B,D)	
Fluoride		1,000	CA PHG ^(E)	100
Nitrate (as N)		10,000	USEPA Primary MCL ^(C)	
Nitrite (as N)		1,000	CA/USEPA Primary MCL ^{(A) (C)}	400
Phosphorus (orthophosphate, total phosphorus)				
Sulfate		250,000	CA Secondary MCL ^(B)	500

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TABLE A-1
Data Needs and Uses – Regulatory Limits for Organic Parameters and Emergent Compounds
Quality Assurance Project Plan, Omega OU-2

Inorganic Parameter	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DH DLR (µg/L) ⁽³⁾
Total dissolved solids (TDS)	Evaluate groundwater treatment alternatives and treated groundwater discharge options Exceedances with respect to federal and state drinking water standards, and state action levels	250,000	CA/USEPA Secondary MCL ^(6,D)	

NOTES:

(1) ARARs from June 2003 California EPA Compilation of Water Quality Goals and Updates through September 2003.

(2) Calculated ARAR based on hardness = 120 mg/L as CaCO₃.

(3) California Department of Health Services required Detection Limit for Purposes of Reporting (DLR).

(4) 0.2 µg/L detection level is needed for comparability to other databases in the region per previous DHS limit.

(A) CA Department of Health Services Primary MCL for Drinking Water.

(B) CA Department of Health Services Secondary MCL for Drinking Water.

(C) USEPA Primary MCL for Drinking Water.

(D) USEPA Secondary MCL for Drinking Water.

(E) CA Office of Environmental Health Hazard Assessment Public Health Goal for Drinking Water.

(F) CA Department of Health Services State Action Level for Toxicity.

(G) CA Proposition 65 Regulatory Level for Drinking Water.

(H) California Toxics Rule for Freshwater Aquatic Life Protection - Continuous (4-day average) Concentration.

(I) California Toxics Rule for Freshwater Aquatic Life Protection - Maximum (1-hr average) Concentration.

(J) Other Taste and Odor Thresholds.

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TABLE A-2
Measurement Performance Criteria
Quality Assurance Project Plan for Omega OU-2

Parameter	Method	Target Detection Limit ^(h)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Volatile Organic Compounds					
TCL Volatile Organic Compounds (VOCs) plus MTBE ^a	EPA 524.2/CLP ^b	(c)	70-130/CLP	±30/CLP	90
TCL ^a Semivolatile Organic Compounds (SVOCs)	CLP ^b	(c)	CLP		
Emergent Compounds					
1,4-Dioxane	EPA 8270 ^b	1 µg/L	40-130	±30	90
NDMA	Modified EPA Method 1625 ^b	0.02 µg/L	50-125	±30	90
Perchlorate	EPA 314 ^{b,d}	5 µg/L	50-150	±50	90
Hexavalent Chromium	EPA 218.6 ^{b,d}	0.2 µg/L	70-140	±30	90
1,2,3 TCP	(i)	0.005 µg/L	(i)	(i)	90
Groundwater Treatment and Discharge Parameters					
TAL ^a Metals (field-filtered) plus Boron, Silicon	EPA 200.7 ^{d,b} EPA 200.8 ^{d,b} EPA 245.1/CLP	(g)	70-130	±30	90
Cyanide	EPA 335.4 ^{d,b}	10 mg/L	75-125	±25	90
Bromide	EPA 300.0 ^{d,b}	1.0 mg/L	75-125	±25	90
Chloride	EPA 300.0 ^{d,b}	1.0 mg/L	75-125	±25	90
Fluoride	EPA 300.0 ^{d,b}	0.1 mg/L	75-125	±25	90
Nitrate-N	EPA 300.0 ^{d,b}	0.1 mg/L	75-125	±25	90
Nitrite-N	EPA 300.0 ^{d,b}	0.1 mg/L	75-125	±25	90
Orthophosphate-P	EPA 300.0 ^{d,b}	1.0 mg/L	75-125	±25	90
Total Sulfate	EPA 300.0 ^{d,b}	1.0 mg/L	75-125	±25	90
Total Kjeldahl Nitrogen (TKN)	EPA 351.2 ^{d,b}	0.3 mg/L	75-125	±25	90
Ammonia	EPA 350.2 ^{d,b}	0.3 mg/L	75-125	±25	90
Total Phosphorus	EPA 365.4 ^{d,b}	0.3 mg/L	75-125	±25	90
Total Dissolved Solids (TDS)	EPA 160.1 ^{d,b}	20 mg/L	75-125	±25	90
Alkalinity	SM 2320B ^{b,e}	20 mg/L	75-125	±25	90
Total Organic Carbon	EPA 415.1 ^d	2.0 mg/L	75-125	±30	90

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TABLE A-2
Measurement Performance Criteria
Quality Assurance Project Plan for Omega OU-2

Parameter	Method	Target Detection Limit ^(h)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
BOD	SM 5210B ^g	3 mg/L	75-125	±25	90
COD	SM5220D ^g	5.0 mg/L	75-125	±30	90
Field Analyses for Volatile Organics	(j)	(i)	(i)	(i)	90

^a Target Compound List (TCL) and Target Analyte List (TAL) as shown in Table A-1 and Appendix B. MTBE: methyl tert-butyl ether.

^b Volatile organics, semivolatile organics, metals and cyanide may be analyzed by the EPA Contract Laboratory Program (CLP) Statement of Work or the equivalent EPA Regional Laboratory Standard Operating Procedures shown in Appendix B, depending on availability. For other analytes, the analyses will be carried out by EPA Regional Laboratory or a Contract Laboratory. EPA Regional Laboratory specifications or data quality indicator specifications have been provided in Appendix B.

^c For volatile organics, detection limits will be at 1 part per billion (ppb) for all except 0.5 ppb for vinyl chloride, carbon tetrachloride, 1,2 dichloroethane, cis and trans-1,3-dichloropropene, and 2 ppb for 1,2-dibromo-3-chloropropene. CLP detection limits are shown in Appendix B.

^d U.S. Environmental Protection Agency, 1979. *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, revised March 1983; U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste*, SW846.

^e *Standard Methods for the Examination of Water and Wastewater*, 17th Edition (1989).

^f State of California Department of Health Services (DHS) Method Determination of Perchlorate by Ion Chromatography, as detailed in EPA Region IX SOP in Appendix B.

^g Detection limits provided in Appendix B along with methods for the specific metals. Silicon to be determined as silica by EPA 200.7 and will have a detection level < 0.1 part per million (ppm).

^h Target detection level is reporting level, see text for explanation.

ⁱ The method and QA/QC will follow California State guidance to achieve the needed low regulatory limit. Laboratory-specific standard operating procedures will be defined prior to start of work, and subsequent to selection of laboratory.

^j Volatile organics to be analyzed in the field will be the same list as the offsite laboratory analyses (a), target detection levels will also be equivalent to the offsite laboratory analyses. Method will be based on 8260/GC/MS. Method and field laboratory-specific standard operating procedures will be defined prior to start of work.

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Figure A-1 Project Organization

SCO Graphics PC Archive/183120/PP.01/WA174 ProjectOrgChart rev0.PPT

Figure A-2 Data Users/Recipients

SCO Graphics PC Archive/183120/PP.01/WA174 DataUsersChart rev0.PPT

Figure A-3 Site Map

Section B

Measurement Data Acquisition

This section presents sampling process design and requirements for sampling methods, sample handling and custody, analytical methods, QC, and instrumentation for the sampling activities that will be conducted as a part of the RI/FS at the Omega Chemical Superfund site. Data acquisition requirements and data management for these sampling events are also addressed in this section.

B.1 Sampling Process Design

B.1.1 Background

Background information and objectives are presented in Section A. The primary objectives of this RI/FS are to delineate the vertical and lateral extent of groundwater contamination at the OU-2 site and investigate potential source areas other than the Omega facility.

B.1.2 Schedule of Analyses

The field investigation is expected to last approximately 2 years after mobilization.

B.1.3 Rationale for Sampling Design

Sampling Locations and Number of Samples

Soil, soil gas, and groundwater sample locations and number of samples are summarized in Section 3 of the accompanying FSP.

Laboratory Analyses

Samples will be analyzed at the EPA CLP laboratories, EPA Regional Laboratory and/or Contract Laboratories.

The analytical parameters for the individual samples are detailed in Table A-2 as well as the accompanying FSP in the request for analyses tables.

B.2 Sampling Method Requirements

Sampling method requirements have been detailed in the associated FSP in Section 5.

B.3 Sample Handling and Custody Requirements

A sample is physical evidence collected from a hazardous waste site, from the immediate environment, or from another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they

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are introduced as evidence. In addition to field notebooks, there are a number of documents for tracking sample custody.

Field documents, including sample custody seals, chain-of-custody (COC) records, and packing lists, will be obtained from the Regional Sample Control Center (RSCC) in the Region IX Laboratory; this will be preceded with the RSCC request form. COC procedures will be used to maintain and document sample collection and possession. After sample packaging, the following one or more of the COC paperwork forms will be completed, as necessary, for the appropriate samples:

- Organic traffic report and COC record
- Inorganic traffic report and COC record
- EPA Region IX COC Record
- Overnight shipping courier air bill

Copies of the above forms will be filled out and distributed per instructions for sample shipping and documentation in Appendix B of the FSP (EPA, 2004). Completed field QA/QC summary forms will be sent to the RSCC at EPA's Region IX Quality Assurance Office at the conclusion of each sampling event.

B.3.1 Chain-of-Custody

Because samples collected during any investigation could be used as evidence, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. COC procedures are followed to document sample possession.

B.3.1.1 Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- It is in your possession.
- It is in your view, after being in your possession.
- It was in your possession and then you locked it up to prevent tampering.
- It is in a designated secure area.

B.3.1.2 Field Custody

In collecting samples for evidence, only enough to provide a good representation of the media being sampled will be collected. To the extent possible, the quantity and types of samples and sample locations are determined before the actual fieldwork. As few people as possible should handle samples.

The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched properly.

The SM determines whether proper custody procedures were followed during the field work, and decides if additional samples are required.

B.3.1.3 Transfer of Custody and Shipment

Samples are accompanied by a COC record. When transferring samples, the individuals relinquishing and receiving sign, date, and note the time on the record. This record

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documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples are packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate COC record accompanying each shipping container (one for each field laboratory, and one for samples driven to the laboratory). Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier names, and other pertinent information, are entered in the "Received by" section of the COC record.

Whenever samples are split with a facility owner or agency, it is noted in the remarks section of the COC record. The note indicates with whom the samples are being split, and is signed by both the sampler and recipient. If the split is refused, this will be noted and signed by both parties. If a representative is unavailable or refuses to sign, this is noted in the remarks section of the COC record. When appropriate, as in the case where the representative is unavailable, the COC record should contain a statement that the samples were delivered to the designated location at the designated time.

All shipments are accompanied by the COC record identifying its contents. The original record and yellow copy accompanies the shipment to the laboratory, and the pink copy is sent to be retained by the SM.

If sent by mail, the package is registered with return requested. If sent by common carrier, a bill of lading is used. Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

B.3.1.4 Laboratory Custody Procedures

A designated sample custodian accepts custody of the shipped samples, and verifies that the packing list sample numbers match those on the COC records. Pertinent information as to shipment, pickup, and courier is entered in the "Remarks" section. The custodian then enters the sample numbers into a bound notebook, which is arranged by project code and station number.

The laboratory custodian uses the sample identification number or assigns a unique laboratory number to each sample, and is responsible for seeing that all samples are transferred to the proper analyst or stored in the appropriate secure area.

The custodian distributes samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they are received, until the sample is exhausted or returned to the custodian. The data from sample analyses are recorded on the laboratory report form.

When sample analyses and necessary QA checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying stickers, data sheets, and laboratory records are retained as part of the documentation. Sample containers and remaining samples are disposed of in compliance with all federal, state, and local regulatory requirements.

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B.3.2 Custody Seals

When samples are shipped to the laboratory, they must be placed in containers sealed with custody seals. One or more custody seals must be placed on each side of the shipping container (cooler).

B.3.3 Field Notebooks

Typical field information to be entered in the field notebook is included in Section 5.10 of the companion FSP (EPA, 2004). In addition to COC records, a bound field notebook must be maintained by each STL to provide a daily record of significant events, observations, and measurements during field investigations. All entries should be signed and dated. It should be kept as a permanent record.

These notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project, and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence.

B.3.4 Corrections to Documentation

All original data recorded in field notebooks, sample identification tags, COC records, and receipts-for-sample forms will be written with waterproof ink, unless prohibited by weather conditions. None of these accountable serialized documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one team, the team leader may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

B.4 Analytical Methods Requirements

Project analytes, methods, and required detection levels have been listed in Table A-2. The analyses for volatiles, semivolatiles, and metals will be per EPA CLP methodology and laboratories or the EPA Regional Laboratory depending on availability. As required, if detection limits and the analyte lists differ from the standard CLP lists, the analyses will be carried out per special services provisions currently available under the CLP. A low-level ICP/MS statement of work (ILM 5.1) may be used for metals. Similarly, a low-level organic statement of work (OLC 3.2) or larger sample volumes may be used to attain lower-level organic detection limits. Samples for VOCs in soil will be collected and preserved following EPA Method 5035. If the CLP is unavailable, the analyses can be carried out at the EPA Regional Laboratory using the laboratory's standard operating procedures and QA equivalent to the CLP per standard operating procedures in Appendix B.

The analyses for other analytes in Table A-2 will be per the EPA Regional Laboratory standard operating procedures or the data quality indicators provided in Appendix B. The

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analyses may be carried out by the Regional Laboratory or Contract Laboratories, depending on availability.

For 1,2,3 TCP the method and QA/QC will follow California State guidance to achieve the needed low regulatory limit. Laboratory-specific standard operating procedures will be defined prior to start of work, and subsequent to selection of the laboratory.

Volatile organics to be analyzed in the field will be the same as those listed for the offsite laboratory analyses; target detection levels will also be equivalent to the offsite laboratory analyses. The method will be based on 8260/GC/MS. The method and field laboratory-specific standard operating procedures will be defined prior to start of work.

B.5 Quality Control Requirements

B.5.1 Field QC Procedures

QC requirements related to the sample collection process (i.e., design, methods, handling, and custody) requirements have been discussed in the previous sections of this document.

Field QC samples include field duplicates, field blanks, and laboratory QC samples (for matrix spike/matrix spike duplicates [MS/MSDs]). QC samples will be collected immediately following collection of target samples, using the same procedures as those used for collection of the target sample. These procedures are presented in the accompanying FSP (EPA, 2004).

B.5.2 Laboratory Procedures

Laboratory QC procedures will include the following:

- Analytical methodology according to specific methods listed in Table A-2.
- Instrument calibrations and standards as defined in specific methods listed in the CLP statement of work.
- Laboratory blank measurements per CLP statement of work.
- Accuracy and precision measurements per CLP statement of work, at a minimum of 1 in 20, 1 per batch.
- Data reduction and reporting according to specific methods listed in Table A-2.
- Laboratory documentation equivalent to the CLP statement of work.

The full CLP-type data package and validation will not be required for the screening (discrete) groundwater samples and IDW samples.

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B.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Instrument maintenance logbooks are maintained in laboratories at all times. The logbooks, in general, contain a schedule of maintenance, as well as a complete history of past maintenance, both routine and nonroutine.

Preventive maintenance is performed according to the procedures described in the manufacturer's instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance. Chromatographic carrier gas-purification traps, injector liners, and injector septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the QC criteria.

Instrument downtime is minimized by keeping adequate supplies of all expendable items, where expendable means an expected lifetime of less than 1 year. These items include gas tanks, gasoline filters, syringes, septa, gas chromatography (GC) columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, open-split interfaces, and mass spectroscopy filaments.

Preventive maintenance for field equipment (e.g., pH meter) will be carried out in accordance with procedures and schedules outlined in the particular model's operation and maintenance handbook.

B.7 Instrument Calibration and Frequency

The following subsections review instrument calibration and frequency information.

B.7.1 Field Calibration Procedures

For water analyses, field equipment requiring calibration includes: pH, electrical conductivity (EC), temperature, dissolved oxygen and oxidation/reduction potential meters. These meters will be calibrated before the start of work and at the end of the sampling day. Any instrument "drift" from prior calibration should be recorded in a field notebook. Calibration will be in accordance with procedures and schedules outlined in the operations and maintenance manual for the particular instrument.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due will be physically attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device must be removed from service, tagged so that it is not

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inadvertently used, and the appropriate personnel notified so that a recalibration can be performed, or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use, or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

Results of activities performed using equipment that has failed recalibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented and the task manager and QA/QC reviewer will be notified.

B.7.2 Laboratory Calibration Procedures

Laboratory calibration procedures are specified in the referenced methods for all parameters listed in Table A-2.

B.8 Data Acquisition Requirements (Nondirect Measurements)

Previously collected data and other information will be used to assist decisionmaking during the RI/FS. These data will be in both hard copy and electronic format. Electronic data will be handled by the electronic data management system described below.

B.9 Data Management

All data for all parameters will undergo two levels of review and validation: (1) at the laboratory, and (2) outside the laboratory as described in Section D. Following receipt of validated data, it will be input into the project database to facilitate database inquiries and report preparation. The data will be stored in the databases with all laboratory qualifiers included. Established data queries and formats developed during the previous work assignments (WAs) will be adapted for incorporation of laboratory data from ASCII files, provided by EPA's QAO, to files compatible with the project database. The database will be maintained in a manner that is compatible with, and provided to, EPA or others at EPA's request. Major components for complete data management will be as follows:

- **Data Conversion/Manipulation/Review.** Reports of data from sampling are received from the QAO in hardcopy or electronic format. These data must be converted, input, reviewed, and QC checked.

In addition, available data from other sources may be incorporated into the database. These data will need to be manually input, output, reviewed, QC checked, then uploaded into the database.

- **Preparation of Tables.** Data tables will be prepared following receipt of validated data from the QAO following each sample event of the WA. Queries will be created for the database to generate updated tables.
- **Database Documentation.** An update of the database and complete documentation will be performed at the end of the project. The commands, file names, and general operating procedures for all the data queries will be documented as directed by the EPA

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WAM. This documentation will be provided to EPA and transferred to others (at EPA's request).

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Section C

Assessment/Oversight

C.1 Assessment and Response Actions

The review team and the SM will monitor the performance of the QA procedures. If problems arise and the WAM directs the SM, the review team will conduct field audits, currently not scheduled or included in the Statement of Work. Audits may be scheduled to evaluate (1) the execution of sample identification, COC procedures, field notebooks, sampling procedures, and field measurements; (2) whether trained personnel staffed the sample event; (3) whether equipment was in proper working order (i.e., calibration); (4) the availability of proper sampling equipment; (5) whether appropriate sample containers, sample preservatives, and techniques were used; (6) whether sample packaging and shipment were appropriate; and (7) whether QC samples were properly collected.

The analyses are expected to be performed by the EPA CLP Laboratories, the EPA Regional Laboratory, and/or Contract Laboratories. The distribution of analyses may change at the time of analyses depending on availability. The QA of the CLP is centrally managed by EPA. The QA of the Regional Laboratory is managed by the EPA QAO. Laboratories subcontracted to CH2M HILL, if any, will be selected based on prior performance on Regional Superfund projects. Additionally, onsite audits or performance evaluation samples will be administered by the project QAO, as necessary.

Audits will be followed up with an audit report prepared by the reviewer. The auditor will also debrief the laboratory or the field team at the end of the audit and request that the laboratory or field team comply with the corrective action request.

C.1.1 Reporting and Resolution of Issues

If QC audits result in detection of unacceptable conditions or data, the SM will be responsible for developing and initiating corrective action. The WAM will be notified if nonconformance is of program significance or requires special expertise not normally available to the project team. In such cases, the remedial project manager (RPM) will decide whether any corrective action should be pursued. Corrective action may include the following:

- Reanalyzing samples if holding time criteria permit
- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data acknowledging a level of uncertainty

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C.2 Reports to Management

The SM or WAM may request that a QA report be made to the WAM on the performance of sample collection and data quality. The report will include the following:

- Assessment of measurement data accuracy, precision, and completeness
- Results of performance audits
- Results of systems audits
- Significant QA problems and recommended solutions

Monthly progress reports will summarize overall project activities and any problems encountered. QA reports generated on sample collection and data quality will focus on specific problems encountered and solutions implemented. Alternatively, in lieu of a separate QA report, sampling and field measurement data quality information may be summarized and included in the final reports summarizing field activities (e.g., well installation or aquifer testing technical memoranda). The objectives, activities performed, overall results, sampling, and field measurement data quality information of the project will be summarized and included in the final field activities reports along with any QA reports.

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Section D

Data Validation and Usability

D.1 Data Review, Validation, and Verification Requirements

All data for all parameters, with the exception of the screening (discrete) groundwater samples and IDW samples, will undergo two levels of review and validation: 1) at the laboratory, and 2) outside the laboratory. Analyses carried out by CLP laboratories will be reviewed by the EPA Quality Assurance Management Section or their designee. Analyses carried out by the EPA Regional Laboratory will be reviewed by the contractor independent of the laboratory.

Data will be reviewed outside the laboratory at the following level of effort:

1. For sampling episodes where few samples are analyzed (one to two batches) data will be reviewed at Tier 3 as defined by the regional QAO guidance.
2. For sampling episodes where there are more than two batches, data will be reviewed at Tier 2 and Tier 3. Ninety-percent of the groundwater sample analytical batches will be reviewed for all the analytical parameters, detections and nondetections, at Tier 2, as defined by the regional EPA QAO guidance. Also, 10 percent of the analytical batches will be selected for Tier 3 for all parameters, detections and nondetections. The analytical batches selected for Tier 3 review will be selected at random, unless a new laboratory is performing the analyses. In this instance, the first analytical batch should undergo the Tier 3 review as a proactive measure.

Tier 2 review has been selected to provide for review of all the QA/QC summary forms in accordance with EPA CLP National Functional Guidelines for Inorganic/Organic Data review (to include all calibrations and internal standards) and flagging of the individual results, as opposed to review of a subset of the QC data as is the case for Tier 1 review. Tier 2 economizes the laboratory data review compared to Tier 3 by limiting the review to QC summary data as opposed to raw data checks. Review of QC summary data that includes all QC parameters provides for the needed comprehensive coverage; this scope is covered under the current Regional Tier 2 review.

The level of effort detailed above is based on the objectives of this project and deal with quantitative evaluation of samples at trace levels for all analytes. The full database requires consistent flags for comparable and reproducible data, which should be met with this level of effort. These levels of effort are appropriate because data are compared quantitatively to past data to establish quantitative trends, as well as compared to regulatory limits. Quantitative trends apply to all analytes, not just a subset of the target analytes. All analytes are contaminants of concern, even though, for example, TCE may be detected more frequently than other analytes. Establishing the validity of nondetect results is as important as the detected results for monitoring, thus both detections and nondetect results will be reviewed.

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D.2 Validation and Verification Methods

Initial data reduction, validation, and reporting at the laboratory will be performed as described in the laboratory standard operating procedures.

Independent data validation by EPA or their designee will follow EPA *Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review* (EPA, 1994, 1999, and 2002) as described above.

D.3 Reconciliation with Data Quality Objectives

Results obtained from the project will be reconciled with the requirements specified in Table A-2 of this QAPP. Assessment of data for precision, accuracy, and completeness will be per the following quantitative definitions.

D.3.1 Precision

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

RPD = relative percent difference
 C_1 = larger of the two observed values
 C_2 = larger of the two observed values

If calculated from three or more replicates, use relative standard deviation (RSD) rather than relative percent difference (RPD):

$$RSD = (s / \bar{y}) \times 100\%$$

RSD = relative standard deviation
 s = standard deviation
 \bar{y} = mean of replicate analyses

Standard deviation, s , is defined as follows:

$$s = \sqrt{\frac{\sum_{i=1}^n (y_i / \bar{y})^2}{n - 1}}$$

s = standard deviation
 y_i = measured value of the i^{th} replicate
 \bar{y} = mean of replicate analyses
 n = number of replicates

D.3.2 Accuracy

For measurements where matrix spikes are used:

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$$\%R = 100\% \times \left[\frac{S - U}{C_{sa}} \right]$$

%R = percent recovery
 S = measured concentration in spiked aliquot
 U = measured concentration in unspiked aliquot
 C_{sa} = actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes:

$$\%R = 100\% \times \left[\frac{C_m}{C_{sm}} \right]$$

%R = percent recovery
 C_m = measured concentration of SRM
 C_{sm} = actual concentration of SRM

D.3.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \times \left[\frac{V}{T} \right]$$

%C = percent completeness
 V = number of measurements judged valid
 T = total number of measurements

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Camp Dresser & McKee (CDM). 2003. *Final On-Site Soils Remedial Investigation/Feasibility Study Work Plan*.

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Appendix A Data Quality Objectives

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Data Quality Objectives (DQOs)
Well Construction, Aquifer Testing, and
Groundwater Sampling
Remedial Investigation/Feasibility Study
Omega Chemical Superfund Site Operable Unit 2

Step 1. State the Problem

- (1) *Identify members of the planning team* – The members of the planning team are the Environmental Protection Agency (EPA) Work Assignment Manager (WAM), CH2M HILL Site Manager (SM), CH2M HILL Staff Hydrogeologists, and CH2M HILL Quality Assurance Officer (QAO).
- (2) *Identify the primary decision-maker* – There will not be a primary decision-maker. Decisions will be made by consensus.
- (3) *Develop a concise description of the problem* – The Omega Chemical Corporation (Omega) is a former refrigerant/solvent recycling operation located in Whittier, California, a community of approximately 85,000 people. Existing groundwater and soil data indicate that elevated concentrations of volatile organic compounds (VOCs) and other compounds are present in the soil and groundwater beneath the former Omega Chemical Facility (Operable Unit 1 [OU-1]) and up to 2 miles downgradient in shallow groundwater. A series of soil gas, soil, and groundwater investigations have been performed at OU-1 by a variety of consultants beginning in 1985. Chlorinated hydrocarbons (primarily PCE, TCE, 1,1-DCE, cis-1,2-DCE, and chloroform) and Freons (Freon 11 and Freon 113) were identified as the primary chemicals of concern directly beneath the site. Elevated total chromium also was reported in groundwater beneath the Omega site. Perchlorate contamination is suspected. Other contaminants of concern (detected or suspected at the site) include cyanides, NDMA, pesticides and PCBs, dissolved metals, and 1,4-dioxane. Elevated concentrations of chemicals of concern were also reported west and southwest of the Omega facility, suggesting that a downgradient migration of the contaminant plume from the site has occurred.

Operable Unit 2 (OU-2) generally includes the groundwater-contaminated areas encompassing the Omega Chemical Facility and extends approximately 2.2 miles to the southwest. The vadose zone contamination at the Omega site and the highly contaminated portion of the aquifer in the immediate site vicinity are addressed as OU-1 under a separate effort. The primary objective of this investigation is to conduct an RI/FS to estimate the vertical and lateral extent of groundwater contamination within OU-2.

EPA has conducted a record search that indicated industrial facilities other than Omega Chemical likely contributed to groundwater contamination within OU-2. The current understanding is that the groundwater contamination present at OU-2 is a continuous, co-mingled plume originating from multiple source areas. This investigation will assess the continuity of groundwater contamination at OU-2 and characterize the main source areas of the contamination. Many of these facilities are currently under a regulatory

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oversight and the extent of contamination has been addressed by remedial investigation. As part of the Omega investigation, reports on these sites maintained at the Los Angeles Regional Water Quality Control Board (LA RWQCB) and Department of Toxic Substances Control (DTSC) will be reviewed and the information compiled and evaluated.

It is possible that characterization of some of the potential sources has not been completed and will need to be addressed under this investigation. Because the extent of such effort is unknown at this time, it is not included in this QAPP and will be addressed by an addendum to this document after additional information becomes available. It is anticipated that such future investigation, if necessary, will include soil gas and soil sampling, well installation, and aquifer testing.

The problem is summarized as follows:

- (a) The vertical and lateral extent, as well as the nature of contamination in groundwater beneath OU-2 needs to be determined. The trend in contaminant concentrations in groundwater needs to be evaluated.
- (b) The risk to human health and the environment from contaminants present at OU-2 needs to be assessed.
- (c) The presence, extent, and concentrations of emergent contaminants (1,4-dioxane, perchlorate, NDMA, hexavalent chromium, and 1,2,3-trichloropropane [1,2,3-TCP]) in groundwater surrounding and downgradient of the Omega site need to be determined.
- (d) The remedial action best suited to site conditions needs to be selected to restore the aquifer, prevent the contamination of nearby drinking water wells, prevent ongoing contamination migration, and prevent exposure to humans and the environment.
- (e) Investigation-derived waste (IDW) generated during field activities (e.g., drill cuttings, well development water, well purge water, and aquifer testing water) will need to be properly disposed in accordance with state, federal, and local regulations.

(4) *Specify available resources and relevant deadlines for the study –*

Although not complete, investigations have been performed previously at the Omega site. The site history, past investigations, and remediation activities are discussed in detail in the *Final On-Site Soils RI/FS Work Plan* (Camp Dresser & McKee [CDM], 2003) and the *Omega Chemical Superfund Site; Whittier, California; Phase 2 Groundwater Characterization Study Report* (Weston Solutions, Inc. [Weston], 2002).

Data obtained in 1988 from site assessment activities, including groundwater and soil sampling conducted by the site owner/operator, Dennis O'Meara, and data from a preliminary assessment conducted by EPA in January 1995, indicated the presence of hazardous substances in subsurface soil and groundwater at the site, including methylene chloride, PCE, and TCE. The presence of these substances and deteriorated underground storage tanks at Omega lead EPA to determine that an imminent and substantial endangerment requiring a removal action existed at Omega. On May 3, 1995,

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EPA issued an Action Memorandum authorizing a Removal Action involving the following response actions:

- Securing the site
- Sampling and categorizing hazardous materials
- Removing hazardous substances and grossly contaminated equipment, structures, and debris
- Sampling surface and subsurface soils and groundwater to determine the nature and extent of contamination
- Disposing, stabilizing, or treating grossly contaminated soils
- Grading, capping, and fencing contaminated soil areas

EPA has divided the Omega Chemical Superfund Site into two Operable Units: OU-1 and OU-2. OU-1 includes the Omega Chemical Facility property and extends a short distance west-southwest to Putnam Street (Weston, 2003). OU-2 surrounds the Omega Chemical Facility and extends offsite approximately 2.2 miles to the southwest. This DQO describes work to be completed within OU-2.

As part of the OU-1 effort, EPA entered into a Partial Consent Decree with the potentially responsible parties (PRPs) who had agreed to complete work at the site. This group is known as Omega Chemical Site PRP Organized Group (OPOG). This Partial Consent Decree was entered into the District Court on February 23, 2001. OPOG agreed to perform an RI/FS, conduct a Non-Time Critical Removal Action, perform a risk assessment, and install groundwater monitoring wells at OU-1, also referred to as the Phase 1A area.

As part of the OU-2 effort, EPA issued an order to another group of PRPs to complete work at OU-2 and initiated settlement negotiations with the remaining PRPs. The resolutions of these actions are pending. In the meantime, EPA authorized its consultant, CH2M HILL, to initiate the RI/FS at OU-2.

Record search conducted by EPA revealed on-going remedial activities at multiple facilities within OU-2. Relevant reports and other documents are available at LA RWQCB and DTSC.

A local water supply well is impacted and continues to be threatened, although it is not known at this time whether the contamination originated at Omega. If no action is taken, drinking water aquifers may become impaired by contamination from Omega and potentially also from other sources within OU-2. The OU-2 RI/FS is scheduled to be completed in 2006. For cost-estimating purposes in support of settlement negotiations, the duration of remedial action (RA) was assumed to be between 2006 and 2038 (remedial system construction between 2006 and 2008, and operation between 2009 and 2038). The time required to achieve aquifer restoration at OU-2 is necessarily longer; but the sense of urgency is nevertheless underscored by the need for taking action.

Step 2. Identify the Decision

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(1) Identify the principal study question –

The apparent problem at the site is the migration to groundwater of chlorinated solvents and associated attenuation products, and potentially of other compounds. The current decision requires adequate data for use in plume delineation, contamination forensic evaluation, assessment of human health and ecological risk, and recommending a remedial action. The concentrations of these VOC and attenuation compounds are greater than background levels for the area and exceed health-based benchmarks in the vicinity of the site. The principal goals for CH2M HILL are to develop a sufficient amount of data to support selection of an appropriate approach for the site remediation and develop a well-supported Record of Decision (ROD). Achieving these goals includes answering the following study questions:

- (a) What is the vertical and lateral extent and nature of contamination in groundwater beneath OU-2, and what is the trend in groundwater concentrations?
- (b) Do contaminants pose an unacceptable potential risk to human health and the environment?
- (c) Are emergent contaminants (1,4-dioxane, perchlorate, NDMA, hexavalent chromium, and 1,2,3-TCP) present in groundwater surrounding and downgradient of the Omega site?
- (d) What remedial action will best suit the site conditions to restore the aquifer, prevent the contamination of nearby drinking water wells, prevent ongoing contamination migration, and prevent exposure to humans and the environment?
- (e) How can IDW (e.g., drill cuttings, well development water, well purge water, and aquifer testing water) be properly disposed in accordance with state, federal, and local regulations?

(2) Define alternate actions that could result from resolution of the principal study question – The alternate actions for goals defined in (1) above will be, respectively:

- (a) (1) The nature and extent of groundwater contamination will be based on existing information, including groundwater samples from past cone penetrometer test (CPT) investigations and a limited number of existing monitoring wells. Uncertainties regarding the extent of the plume will remain and changes in concentrations within areas previously characterized by in-situ samples will not be assessed.

(2) Additional well clusters will be installed and monitored at locations within the plume with no permanent monitoring wells at downgradient and lateral edges of the plume to characterize the lateral and vertical extent of contamination. These wells will be available for future monitoring to evaluate changes in contaminant concentrations in groundwater.
- (b) (1) Additional data collection indicates that there is a risk to human health, (2) no risk, or (3) insufficient data.

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- (c) (1) If emergent chemicals are not present in groundwater, then commonly used technologies for groundwater treatment will be utilized. (2) If emergent chemicals are present, then additional groundwater treatment will be required.
 - (d) Remedial actions that may be considered include no action, natural attenuation, groundwater extraction and treatment system. The site conditions and treatment requirements may require collection of additional data or information to select a remedial action that will best suit the site conditions.
 - (e) Drill cuttings may be disposed as (1) nonhazardous soil in a Class II landfill, or (2) hazardous waste in a Class I landfill. IDW water can be disposed as clean water to a storm drain if no contaminants exceeding maximum contaminant levels (MCLs) or Action Levels (ALs) are present. Wastewater containing contaminants above ALs or MCLs must be treated onsite or disposed at a treatment, storage, and disposal facility (TSDF).
- (3) *Combine the principal study question and the alternative actions into a decision statement –*
- (a) If the new understanding of the nature and extent of groundwater contamination is shown to be significantly different than the current understanding, then a different remedial approach may need to be considered. If the new data are not sufficient to adequately characterize the nature and extent of the contamination, then additional wells will be installed and/or the duration of monitoring extended.
 - (b) If the contaminants at OU-2 pose an unacceptable potential risk to human health and the environment, a remedial action will be recommended. No action will be recommended otherwise. A recommendation for collection of additional data will be made if the risk cannot be fully assessed based on the data collected.
 - (c) If emergent contaminants are present, additional treatment technologies for groundwater may be required.
 - (d) If the selection of a remedial action that will best suit the site conditions cannot be made based on the data available, additional data or information will be collected.
 - (e) IDW water will be treated onsite and discharged as clean if onsite treatment is feasible. If IDW water cannot be treated onsite, it will be disposed at a TSDF. If drill cuttings have not met nonhazardous waste criteria, they will need to be placed in a Class I landfill. If drill cuttings have met nonhazardous waste criteria, they will be placed in a Class II landfill.
- (4) *Organize multiple decisions –* Based on the answers to the principal study questions, decisions about alternate actions and additional phases of RI/FS activities will be made during the progress of the RI/FS. The resolution of 3(b) and 3(c) may impact 3(a) by requiring that additional data or information be collected.
- (a) The updated assessment of the nature and extent of contamination may indicate that the VOC plume has migrated further downgradient or to a greater depth than is currently expected. If so, it may result in the need for additional monitoring wells and extended groundwater monitoring.

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- (b) If a risk of exposure is determined to exceed human health or ecological criteria, then a remedial action to reduce that risk to an acceptable level will be recommended.
- (c) The presence of emerging contaminants in groundwater may necessitate additional site characterization and groundwater treatment technology.
- (d) If IDW water can be treated onsite, it will be discharged as clean. If IDW water cannot be treated onsite, it will be disposed at a TSDF. If drill cuttings have not met nonhazardous waste criteria, they will need to be placed in a Class I landfill. If drill cuttings have met nonhazardous waste criteria, they will be placed in a Class II landfill. The range of IDW disposal options was presented and the associated waste profiling specified; evaluation of other disposal options is not required.

Step 3. Identify Inputs to the Decision

The purpose of this step is to identify the information and measurements needed to support the decision statement. The data will be evaluated with regard to the four principal questions of the RI/FS.

- (1) *Identify the information that will be required to resolve the decision statement* – Based on data uses and availability, the following data are needed:

- (a) To resolve the decision statement, the planning team will need contaminant concentration data for groundwater samples from new and existing monitoring wells, and hydrogeological data (including historical) from existing wells, as well as applicable regulatory criteria for the following constituents: VOCs, semivolatile organic compounds (SVOCs), metals, perchlorate, and hexavalent chromium.
- (b) To resolve the decision statement (b), the planning team will need groundwater and soil concentrations of contaminants listed under (a) and (c), appropriate human health risk and ecological risk criteria, information on exposure pathways, and exposure information.
- (c) To resolve the decision statement (c), the planning team will need the analytical results for emerging contaminants (1,4-dioxane; perchlorate; NDMA; 1,2,3-TCP; hexavalent chromium) from site monitoring wells as well as applicable regulatory criteria.
- (d) To resolve the decision statement (d), aquifer hydraulic characteristics derived from aquifer testing will be used to provide information critical to assess contaminant fate and transport and evaluate remediation alternatives. Groundwater elevations and contaminant concentrations in groundwater will be measured to define groundwater flow direction, allow plume tracking over time, and provide calibration data for the numerical model to assess contaminant fate and transport and evaluate remedial alternatives. Analytical results for groundwater samples, including compounds listed under (a) and (c), and additional compounds (nitrate, sulfate, methane, total dissolved solids [TDS], biological oxygen demand [BOD], chemical oxygen demand [COD], pH) will be used to select the treatment technology. Hydraulic conductivity, soil moisture, redox potential, cation exchange

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capacity, and total organic carbon (TOC) will be used to evaluate contaminant fate and transport.

- (e) To resolve the decision statement (e), the planning team will need the analytical results for the IDW, both soil cuttings and groundwater, as well as applicable regulatory action levels and screening criteria.
- (2) *Determine the sources for each item of information identified:* The results from this investigation will provide the necessary information to resolve the decision statement. Data from previous site investigations will be utilized as needed.

- (a) Lithologic and laboratory analytical data from samples collected at new and existing monitoring wells.
- (b) Soil and groundwater analytical data collected during this and previous investigations as well as information on exposure pathways.
- (c) Laboratory analyses of emerging compounds from groundwater samples collected from the new and existing wells.
- (d) Data collected under (a), (b), and (c), aquifer test results, regulatory requirements, cost analysis.
- (e) Laboratory analysis results for samples of IDW water and soil.

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- (3) *Identify the information that is needed to establish the action level* – Action levels will be generated in the risk assessment using EPA guidance.

- (a) The regulatory action levels include California and federal drinking water standards, ALs in California, and California Public Health Goals (PHGs) (Table A-1 in the main text of this QAPP). Method detection limits and historical concentrations, as appropriate, will be used for unregulated drinking water compounds.
- (b) A risk assessor will evaluate human health and ecological risk; specific action levels will not be recommended.
- (c) California ALs will be applied.
- (d) If groundwater treatment is required, discharge options will be guided by MCLs, California ALs, California PHGs, Los Angeles Basin Plan Water Quality Objectives, National Pollutant Discharge Elimination System (NPDES) Permits, California Toxic Rules, and South Coast Air Quality Monitoring District Permits.
- (e) For IDW soil: 40 Code of Federal Regulations (CFR) Section 261.24, 22 California Code of Regulations (CCR) Section 66261.24, and waste acceptance criteria for offsite nonhazardous waste TSDF. For IDW water: California Toxic Rules (40 CFR Section 131.38), 22 CCR Section 64431 (Drinking Water Standards); Department of Health Services (DHS); Office of Environmental Health Hazard Assessment (OEHHA); and best professional judgment.

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- (4) *Confirm that appropriate measurement methods exist to provide the necessary data* – The appropriate methods have been identified to meet project needs and are shown in the QAPP.

Step 4. Define the Boundaries for the Study

- (1) *Specify the characteristics that define the population of interest* –

- (a) Concentrations of chlorinated solvents and their degradation products, and other parameters, including VOCs, SVOCs, pesticides/PCBs, cyanide, perchlorate, and metals in groundwater within shallow unconsolidated sediments.
- (b) Same as (a). The groundwater samples will be collected following a systematic rather than statistical sampling design.
- (c) Concentrations of emerging contaminants in groundwater within shallow unconsolidated sediments.
- (d) Impacted groundwater within shallow unconsolidated sediments.
- (e) IDW soil and water containerized in roll-off bins, tanks, 55-gallon drums, and other storage containers.

- (2) *Define the spatial boundary of the decision statement* –

- (a) Define the geographical area to which the decision statement applies – The boundary of OU-2 is the extent of the contamination in groundwater. One objective of the RI/FS (principal study question a) is to determine the extent of the spatial boundary. This geographical area applies to all principal study questions.
- (b) Divide the population into strata that have relatively homogeneous characteristics – For all the principal study questions, the contaminated aquifer may be considered one stratum.

- (3) *Define the temporal boundary of the decision statement* –

- (a) Determine the timeframe to which the decision statement applies – For principal study questions (a), (b), and (c), the timeframe is 2 years, the duration of the project. For principal study questions (d) and (e), the duration is indefinite because the liability associated with the remedy and IDW disposal extends into the future.
- (b) Determine when to collect data – The anticipated duration of the RI/FS is 2 years (all principal study questions).

- (4) *Define the scale of decisionmaking* – The scale of decisionmaking will be limited to the OU-2 area (the same geographic boundary).

- (5) *Identify practical constraints on data collection* – The sampling locations and schedule may depend on site access, permitting, and right-of-way constraints. For all principal study questions, there are practical funding limitations imposed by Congressional appropriations. The decisions and professional practices will be based on the current scientific understanding of contaminant fate and transport, adverse effects of contaminants on human health and environment, and treatment of contaminated media.

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Step 5. Develop a Decision Rule

- (1) *Specify the statistical parameter that characterizes the population of interest*
 - (a) Sample analysis reports will be compared to action levels. Each value, not a statistical parameter such as mean concentration, will be evaluated against the action levels.
 - (b) Sample analysis reports will be compared to action levels on a point-by-point basis.
 - (c) Sample analysis reports will be compared to action levels. Each value, not a statistical parameter such as mean concentration, will be evaluated against the action levels.
 - (d) The full range of concentrations will be used semi-quantitatively in the evaluation of remedial alternatives.
 - (e) Sample analysis reports will be compared to applicable criteria on a point-by-point basis to characterize IDW soil for disposal and IDW water for treatment and discharge.
- (2) *Specify the action level for the study –See Step 3, Item (3).*
- (3) *Develop a decision rule (an “if...then...” statement) –*
 - (a) If an analytical result is greater than an action limit, then the sampling location can be included in OU-2 and may warrant further investigation.
 - (b) If the assessment of risk concludes the contamination at OU-2 poses an unacceptable risk to human health and/or the environment, a remedial action will be recommended.
 - (c) If emerging contaminants are detected, remedial alternative selection will include appropriate treatment technologies.
 - (d) If the collected data allow for clear identification of remedial alternatives, the alternative selection will be developed; otherwise, additional data or information will be collected.
 - (e) If waste soil profiling indicates the results meet nonhazardous waste criteria, the IDW soil will be shipped to a Class II landfill; otherwise, it will be transported to a Class I landfill. If waste profiling for IDW water indicates it meets regulatory requirements, it will be treated and discharged onsite; otherwise, it will be send to a TSDF.

Step 6. Specify Tolerable Limits on Decision Errors

Tolerable limits on decision errors, which are used to establish performance goals for the data collection design, are specified in this step.

- (1) *Determine the range of the parameters of interest –* The available historical range of the parameters of interest (for principal study questions a, b, c, and d) is known for a portion of OU-2 only. Concentrations of chlorinated hydrocarbons in groundwater ranged from nondetect to tens of thousands of micrograms per liter ($\mu\text{g/L}$).

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Concentrations of perchlorate were less than 7 µg/L. Part of principal study question (a) is to determine the range of contaminant concentrations. The historical range of contaminant concentrations in IDW (principal study question e) was not known at the time of preparation of this document.

- (2) *Identify the decision errors and choose a null hypothesis* – For principal study questions a through d: The DQO guidance prescribes the identification of the null hypothesis and associated decision errors for determining the number of random samples and the locations to attain a given level of confidence with the spatial distribution. Because samples will be collected at systematically selected locations, statistical decision errors cannot be defined. However, project error tolerances are defined in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters in Section A.4 of this QAPP. Analyte-specific accuracy and precision ranges are shown in Table A-2 of this QAPP. The project completeness goal is set at 90 percent. The laboratory data will be evaluated against PARCC requirements as outlined in the QAPP. Possible decision errors will be considered tolerable when data meet stated PARCC goals.

For principal study question e, for IDW soil, guidance published in EPA Publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, will be followed (see Step 7, Item 3). For IDW water, mixing is expected to occur while each Baker tank is being filled, thus providing a well-mixed, homogeneous condition for sample collection.

- (4) *Specify a range of possible values of the parameter of interest where the consequences of decision error are relatively minor* – Not applicable.
- (5) *Assign probability values to points above and below the action level that reflect the tolerable probability for the occurrence of decision errors* – Applies to all principal study questions: Because sample locations are predetermined, probability values cannot be assigned. Instead, error tolerances are defined in terms of the PARCC parameters and are explained in Section A.4 of the QAPP. Needed project accuracy and precision ranges are shown in Table A-2 of the QAPP for the individual analytes. The completeness goal for the project is set at 90 percent.

Step 7. Optimize the Design

- (1) *Review the data quality objective (DQO) outputs and existing data*
- (a) The results will also be compared to historical data and to regulatory action levels (e.g., state and federal MCLs, California ALs, PHGs) as per the objectives described above. Discrete groundwater sampling and screening-level laboratory analysis of the discrete samples will be used to select the screen depth intervals of the new monitoring wells.
 - (b) Existing (i.e., historical) data will also be included in the risk assessment. The analytical results for the discrete-depth groundwater samples and IDW samples will not be used in the risk assessment.
 - (c) The results will also be compared to historical data and to regulatory action levels (e.g., California ALs) as per the objectives described above.

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- (d) Areally averaged concentrations in groundwater will be used to estimate the average influent concentrations, which then can be used for the feasibility evaluation and treatment unit process design.
- (e) The waste profiling results will not be compared to past IDW results. For proper disposal, the waste profiling results will be compared to applicable screening criteria, federal and California hazardous waste action levels, and facility-specific waste acceptance criteria.

(2) *Develop general data collection design alternatives –*

- (a) None anticipated. Sampling will be done from fixed well locations which are based on professional judgment, so there are no alternatives.
- (b) None anticipated. Samples will be collected at locations selected as part of principal study questions a and c.
- (c) None anticipated. Sampling will be done from fixed well locations which are based on professional judgment, so there are no alternatives.
- (d) None anticipated. The feasibility study will use areally averaged results from samples collected at fixed well locations which are based on professional judgment, so there are no alternatives.
- (e) Representative sampling of IDW soil can be achieved either by averaging the results of separate samples collected, or by collecting the samples, compositing first, and then analyzing the composited sample. The IDW water is expected to be relatively well-mixed as holding containers are filled. Given that the constituents are expected to be in the dissolved phase (not in nonaqueous phase), a single sample per container should be representative of the wastewater.

- (3) *For each data collection design alternative, select the optimal sample size that satisfies the objectives* - None anticipated for principal study questions a through d; the sample size is based on professional judgment.

For DQO e, for IDW soil, the optimal sample size (see table below) is based on the requirements listed in EPA Publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*.

Volume (CY)	Minimum No. of Subsamples/Aliquots	Comments
<10	2	1 sample from each half
10 to 20	3	1 sample from each third
20 to 100	4	1 sample from each quarter
>100	1 per 25 CY	1 sample from each 25-CY portion

Note that roll-off bins are each 10-cubic yard (CY) bins and more than one roll-off bin may be grouped together for composite sampling.

For IDW water, one sample per 20,000-gallon tank is expected to be adequate.

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- (4) *Select the most resource-effective data collection design that satisfies the DQOs –*
- (a) The proposed groundwater monitoring well locations were selected to fill data gaps in areas where the extent of the groundwater contamination is not known. Discrete groundwater sampling will be used to select a representative well screen depth and minimize the number of wells necessary.
 - (b) All historical and new data will be used.
 - (c) Same as (a).
 - (d) Same as (b).
 - (e) Attempts will be made to separate relatively clean IDW from contaminated IDW. Compositing of samples from segregated IDW will minimize the number of laboratory analyses.
- (5) *Document the operational details and theoretical assumptions of the selected design in sampling and analysis plan –* The data collection program, including sampling rationale, is presented in the FSP (EPA, 2004).

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Appendix B Analytical Specifications

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